

**CLAIMS:** We claim:

**1. (currently amended)** A device for producing quantum effects, comprising:

- (a) a material fashioned into an elongated fiber shape, as in a wire, ribbon, or optical fiber;
- (b) one or more control paths which carry energy along said fiber;
- (c) quantum dots, whether particles or devices, on the surface of the fiber, which are connected to said control paths and which employ quantum confinement, using the energy or energies in said control paths to trap and hold a controlled configuration of charge carriers, thus forming artificial atoms whose size, shape, atomic number and energy level are dependent on the energies in said control paths;

whereby said fiber can serve as a substitute for quantum dots and quantum wires in existing and future applications, and

whereby the electrical, optical, thermal, magnetic, mechanical, and chemical properties of said fiber can be manipulated through adjustment of the energies in the control paths, thus altering the dopant properties of said artificial atoms, and

whereby said fiber can be embedded inside a bulk material, to serve as a programmable dopant which is capable of altering the electrical, optical, thermal, magnetic, mechanical, and chemical properties of said material in real time based on the energies in said control paths, and

whereby a plurality of said fibers can be woven, braided, or stacked into two- or three-dimensional structures, creating novel materials whose electrical, optical, thermal, magnetic, mechanical, and chemical properties are electrically or optically programmable in real time by means of the energies in said control paths.

**2. (currently amended)** The device of Claim 1 wherein said control paths are electrical wires, whether conductors, semiconductors, or superconductors, which carry electrical voltages.

**3. (original)** The device of Claim 1 wherein said control paths are optical fibers carrying light or laser energy.

**4. (original)** The device of Claim 1 wherein said control paths are radio frequency or microwave antennas.

**5. (currently amended)** The device of Claim 1 wherein the quantum dots are quantum dot particles.

**6. (original)** The device of Claim 1 wherein the quantum dots are quantum dot devices.

**7. (new)** The device of Claim 1 wherein only the atomic number and energy level of the artificial atoms can be controlled.

**8. (new)** The device of Claim 1 wherein only the energy level of the artificial atoms can be controlled.

**9. (currently amended)** A method for controlling dopants in the interior of bulk materials in real time, well after their time of manufacture, comprising:

- (a) confining charge carriers in a dimension smaller than the de Broglie wavelength of said carriers, such that the carriers assume a quantum wavelike behavior in all three dimensions;
- (b) carrying electrical or other energy through conduits to said carriers while embedded in a solid material, without said energy directly contacting said material except through said carriers;
- (c) controlling said energy so that 'artificial atoms' are formed in the confinement region, whose properties can be adjusted in real time;

whereby said artificial atoms serve as programmable dopants to alter the electrical, optical, thermal, magnetic, mechanical, and chemical properties, of said material in real time rather than at the time of manufacture, and

whereby a plurality of said methods can be combined, creating a means for producing novel materials whose electrical, optical, thermal, magnetic, mechanical, and chemical properties can be adjusted in real time rather than at the time of manufacture.

**10. (currently amended)** The method of Claim 9 wherein the means of confining said charge carriers is a plurality of quantum dot particles or quantum dot devices, and said conduits are consolidated into fibers to which said quantum dot particles or quantum dot devices are attached.